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ETHYLENE SOIL APPLICATOR

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Ethylene gas (C_2H_4) has been found to induce germination of witchweed (*Striga lutea*) seed. This gas needs to be injected into the soil to a depth of 4 to 8 inches. It then diffuses throughout the soil, providing the mandatory stimulant necessary to trigger germination of this obligate parasitic weed. The germination is suicidal for the witchweed because of the absence of the necessary nourishment from a host plant for its survival.

The injection of ethylene gas into soil may have uses in other areas of agriculture. Fungistasis activity and enhanced crop production have been suggested. The applicator described herein is suitable for the application of ethylene into cropland to achieve agricultural objectives.

DESCRIPTION

This ethylene injector equipment is designed for three point hitch mounting on a standard (35 HP or more) farm tractor. The tractor must have a three point hitch hydraulic lift and two attachments for independently controlled auxiliary hydraulic equipment.

The unit is basically a tandem drawbar made from 3 x 3/16 inch square steel tubing. The 7-foot center section consists of the three point hitch, and anchor points for hydraulic cylinder which control the outer sections of the boom. It also has three shank injectors attached. The outer sections of the drawbar are attached through a pivot point for vertical pivot hydraulic lifting. Each outer section has two shank injectors attached.

Spring Steel Injectors

Wiese Corp. Item T2545 3/4" x 25" Vibrotines are attached to the drawbar using standard mounting clamps. These injectors are spaced at desired intervals to accommodate crop row widths. They may be placed on 36-inch centers where no crop is present in the field.

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Gas Flow System

The ethylene cylinders are carried in a frame mounted on the front of the tractor as shown in figure 1.

Figure 1.

A two-step pressure reduction and an intermediate expansion chamber are needed as the gas is bled off from the 1200 ± psi cylinder pressure to the 40 psi injection pressure. The equipment in figure 2 utilizes a 10-lb. ethylene cylinder as an expansion chamber. A regulator (Air Products and Chemicals, Inc. model E11-F-N115G) is used to reduce the pressure to 400 psi in the expansion chamber. A dip tube releases the gas near the bottom of the expansion cylinder. The gas is bled off from the top of the expansion cylinder, through a second regulator (Air Products and Chemicals, Inc. model E12-2-N515B) which further reduced presure to 40 psi.

From this regulator, the gas flows through an off-on valve (manual or electric operated), and into the manifold. All hoses to this point are triple steel braided hydraulic hoses with hydraulic type fittings. The manifold divides the flow providing an outlet line for each of the seven injectors. The gas flows from the manifold by plastic tubing to line flowmeters (Air Products and Chemicals, Inc., Item E20-X-37MM15, 10 - 90 SCFH flow range). The rate of flow is adjustable by a needle valve, with a floating ball indicating the rate of flow in cubic feet per hour. Needle valves on the flowmeters can be used to cut off flow to injection shanks not in use. From the flowmeter the gas passes through plastic tubing, to a pipe attached to the trailing edge of the injector shank. It is released through small holes near the bottom of the injector (figure 3).

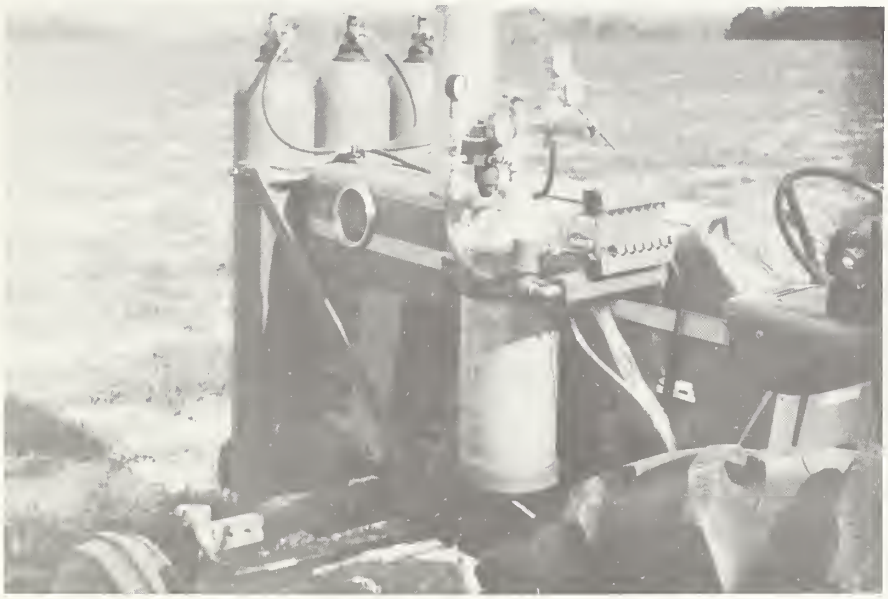

Figure 2.

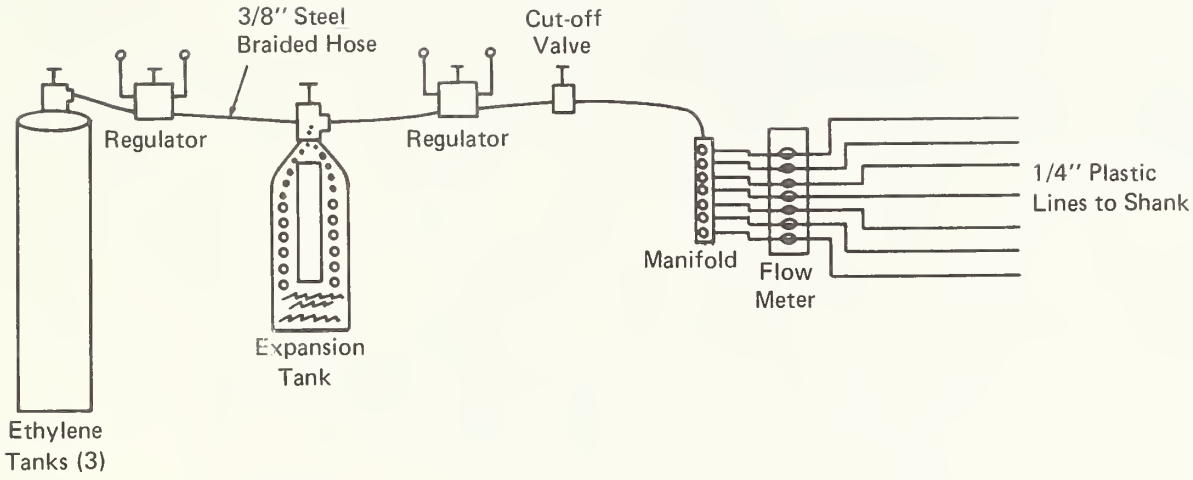

Figure 3.—Gas flow system ethylene injector.

Hydraulic System

The tractor three point hitch hydraulic system is used to control the depth of penetration of the injectors during operation. The dual auxiliary hydraulic controls are used to raise and lower the left and right sections of the boom. This facilitates transport of the equipment and aids in turning. Also, treatments can be made using parts of the boom. An 18-inch stroke 1-inch shaft double action cylinder is used. This cylinder provides both lift for raising the injectors and down pressure to hold the outer injectors in the ground during operation (figure 4).

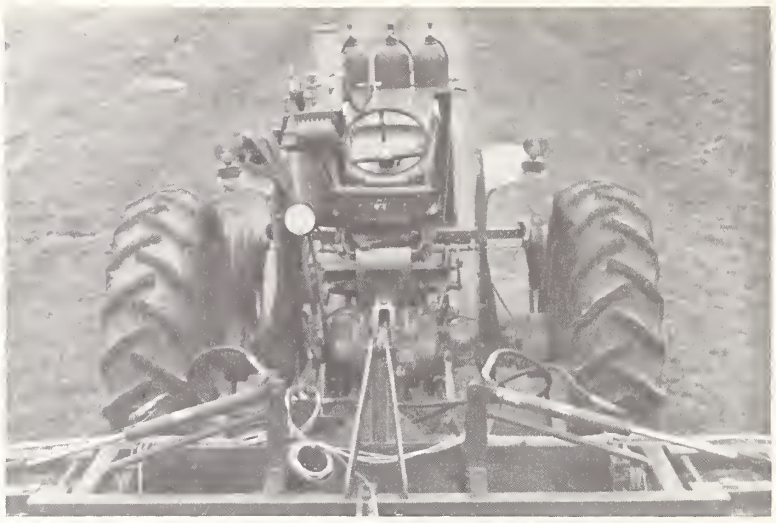

Figure 4.

OPERATION

The equipment can be operated in the field any time that the soil conditions are suitable for cultivation. The ethylene may be applied in row crops, idle land or any place the shanks can be maintained 4 or more inches deep. An operating speed of 4 - 6 mph is recommended. Calibration of the equipment is a function of shank spacing, engine speed, and flow rate. Thirty SCFM with 36-inch spacing of the shanks at 4 mph equals 1.5 pounds of ethylene gas per acre.

Figure 5.